CLAIMS

What is claimed is:

1. An apparatus comprising:

a phase modulator for despeckling an electromagnetic beam, the phase modulator having a plurality of regions which have individually controllable phase modulation; and

a controller coupled to the phase modulator for providing a first phase modulation control input to a first of said regions and a second phase modulation control to a second of said regions.

2. The apparatus of claim 1 wherein the electromagnetic beam is a light beam in the visible spectrum, and the apparatus further comprising a light source for generating the light beam.

3. The apparatus of claim 2 wherein the light source is a laser.

4. The apparatus of claim 1 wherein the controller comprises a random number generator.

5. The apparatus of claim 4 wherein the random number generator comprises a quantum random number generator.

6. The apparatus of claim 5 wherein the random number generator further comprises a filter for removing pink noise content from sets of random numbers provided from the controller to the phase modulator.

7. The apparatus of claim 4 wherein the random number generator comprises a blue noise generator.

8. The apparatus of claim 1 wherein the phase modulator comprises a transmissive device.

9. The apparatus of claim 1 wherein the phase modulator comprises a reflective device.

10. The apparatus of claim 1 wherein the controller changes the phase modulation control inputs to each of the regions at a frequency sufficiently high that any speckles exist for a period which is short enough so as to be substantially masked by the flicker fusion rate of the human eye.

11. A light source comprising:

a coherent light source;

a phase modulator coupled to the coherent light source, the phase modulator including,

a first region, and

a second region; and

a controller coupled to the phase modulator to apply first and second phase modulation controls to the first and second regions, respectively.

12. The light source of claim 11 wherein the phase modulator comprises a phase array.

13. The light source of claim 12 wherein the phase array has three-sided regions.

14. The light source of claim 12 wherein the phase array has four-sided regions.

15. The light source of claim 12 wherein the phase array has six-sided regions.

16. The light source of claim 11 wherein the phase modulator comprises more than ten regions and the controller applies a respective unique values to each respective region during a period of time.

17. The light source of claim 11 wherein the coherent light source provides light in a human-visible spectrum.

18. The light source of claim 11 wherein the coherent light source provides electromagnetic radiation not visible to humans.

19. The video display device of claim 11 further comprising a display screen, wherein the video display device is a television.

20. The video display device of claim 19 wherein the video display device is a projection television.

21. The video display device of claim 11 further comprising a display screen, wherein the video display device is a computer monitor.

22. The video display device of claim 11 wherein the video display device is a projector.

23. The video display device of claim 22 wherein the video display device is a movie theater projector.

24. The video display device of claim 22 wherein the video display device is a direct-to-eye projector.

25. A video display device comprising:

a light source for generating a light beam which exhibits coherence across its cross-section;

a phase shifter including,

a plurality of regions each for receiving a portion of the light beam and for applying a respective phase shift to that portion of the light beam in response to a respective control input;

a controller coupled to the phase shifter for generating the control inputs;

means, coupled to receive the light beam, for modulating the light beam to insert a content image; and

a display screen, coupled to receive, and for displaying the light beam with content image.

26. The video display device of claim 25 wherein the display screen is a television.

27. The video display device of claim 25 wherein the display screen is a projection television.

28. The video display device of claim 25 wherein the display screen is a computer monitor.

29. An apparatus comprising:

a source of coherent light;

a phase array coupled to receive the coherent light, and including a plurality of regions each capable of providing a respective amount of phase shift to light encountering that region; and

a controller coupled to the phase array for providing control inputs to the phase array to vary the amount of phase shift of each region independently and at a frequency higher than the flicker fusion rate of the human eye.

30. The apparatus of claim 29 wherein the source is a laser.

31. The apparatus of claim 29 wherein the control inputs comprise values, including a unique digital value for each respective region of the phase array, and wherein the phase array uses a respective digital value to indicate the amount of phase shift to be provided by the respective, corresponding region.

32. The apparatus of claim 29 wherein the control inputs comprise analog signals.

33. The apparatus of claim 29 wherein:

the control inputs comprise, for each region, a respective value which does not directly indicate phase shift amounts of the respective region; and

the phase array provides phase shifting of each region as a function of the control input for that region and of a previous phase shift amount of that region.

34. A method of displaying a video image, comprising:

generating coherent light;

receiving the coherent light at a phase array having a plurality of independently-controllable phase shift regions;

generating control input values; and

applying the control input values to the phase shift regions.

35. The method of claim 34 further comprising:

at a frequency higher than a flicker fusion rate of a human eye, repeating,

the generation of control input values to generate new control input values, and

the application of the new control input values to the phase shift regions.

36. The method of claim 35 wherein the generation of control input values comprises:

generating a blue noise data stream; and

selecting the control input values from the blue noise data stream.

37. The method of claim 36 wherein the blue noise data stream comprises a 2-D blue noise data stream.

38. The method of claim 29 wherein the generation of control input values comprises:

generating a quantum random number stream; and

applying a blue noise filter to the quantum random number stream to generate a stream of control input values having a low-frequency pattern content lower than a predetermined threshold.

39. An apparatus comprising:

a coherent light source; and

a phase modulation device which,

includes a plurality of regions which provide independent amounts of phase shift according to respective input control values applied to each such region, and

is coupled to the coherent light source so as to remain substantially in mechanical and rotational alignment with the coherent light source.

40. The apparatus of claim 39 further comprising:

a controller coupled to provide the input control values to the phase modulation device.

41. The apparatus of claim 40 wherein the controller comprises:

a blue noise generator.

42. The apparatus of claim 41 further comprising:

a content modulator; and

a display device.

43. An apparatus comprising:

a phase modulator for despeckling an electromagnetic beam, the phase modulator having a plurality of regions which have individually controllable phase modulation;

a controller coupled to the phase modulator for providing a first phase modulation control input to a first of said regions and a second phase modulation control to a second of said regions; and

a receiver device coupled to the phase modulator to receive the despeckled electromagnetic beam.

44. The apparatus of claim 43 wherein the electromagnetic beam is a laser beam and the apparatus comprises a targeted weapons system.